(No Model.)

S. S. ALLIN.

WATER MOTOR.

No. 379,753. Patented Mar. 20, 1888.

FIG. 1.

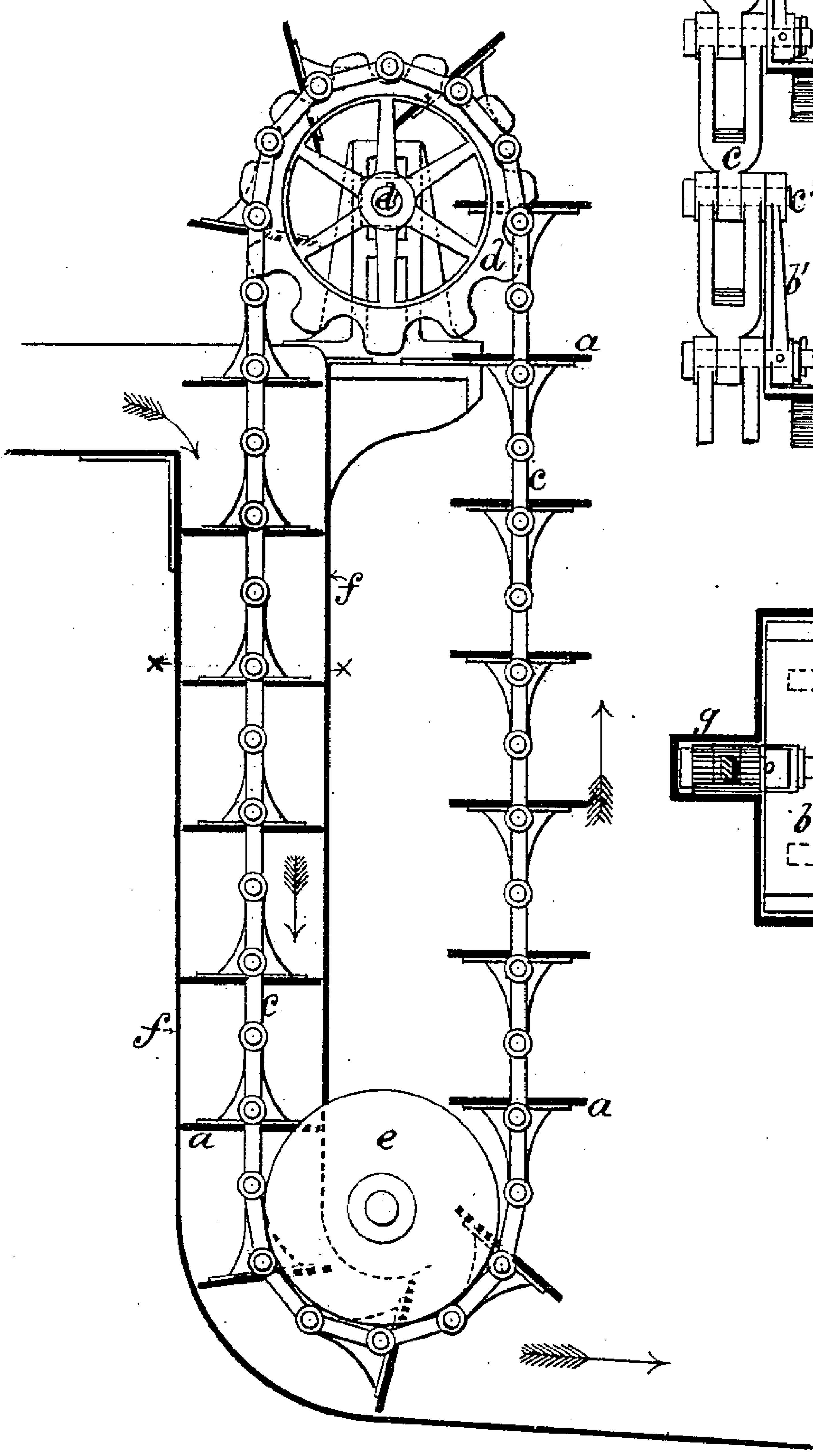


FIG. 2.

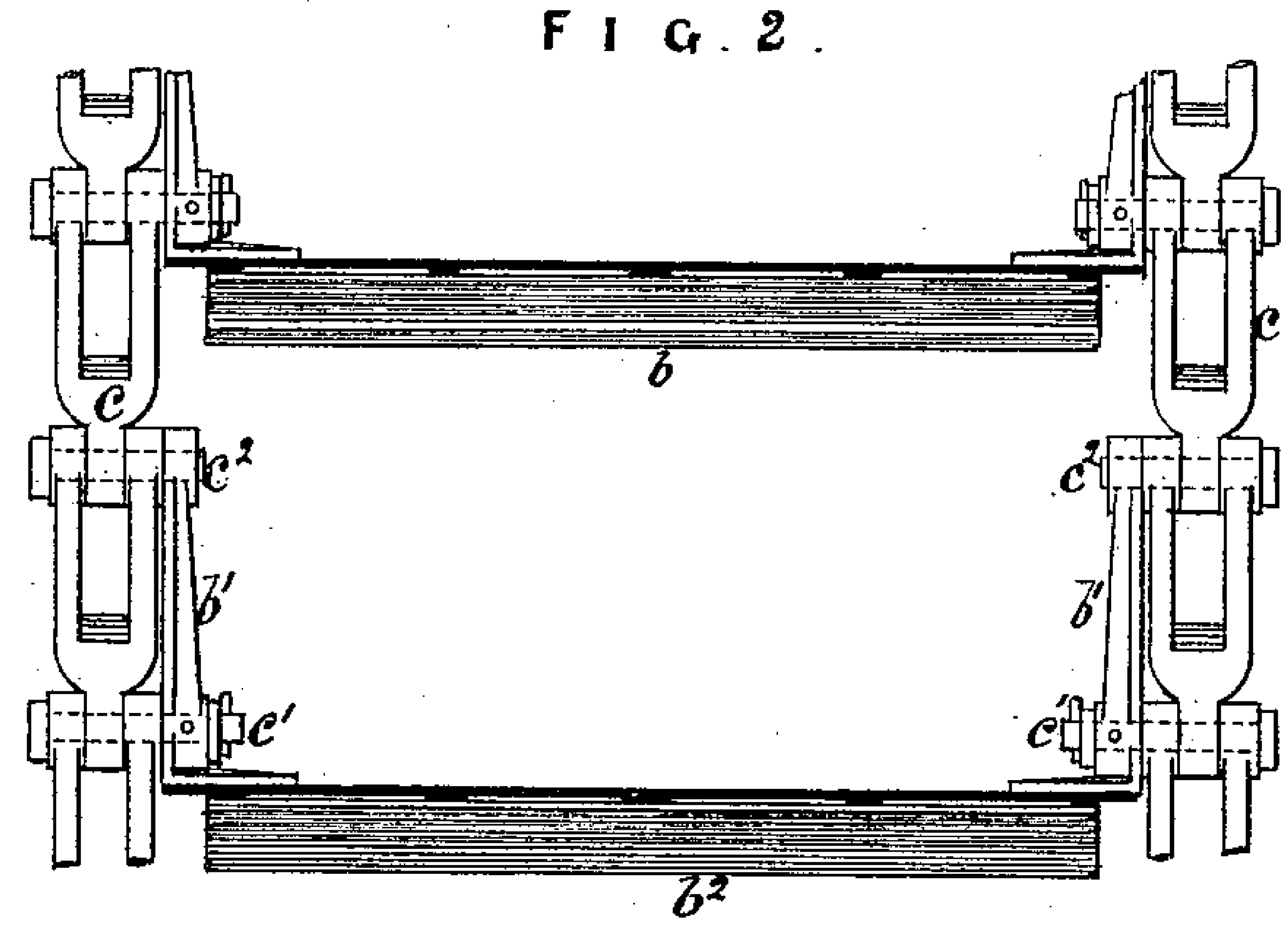


FIG. 4.

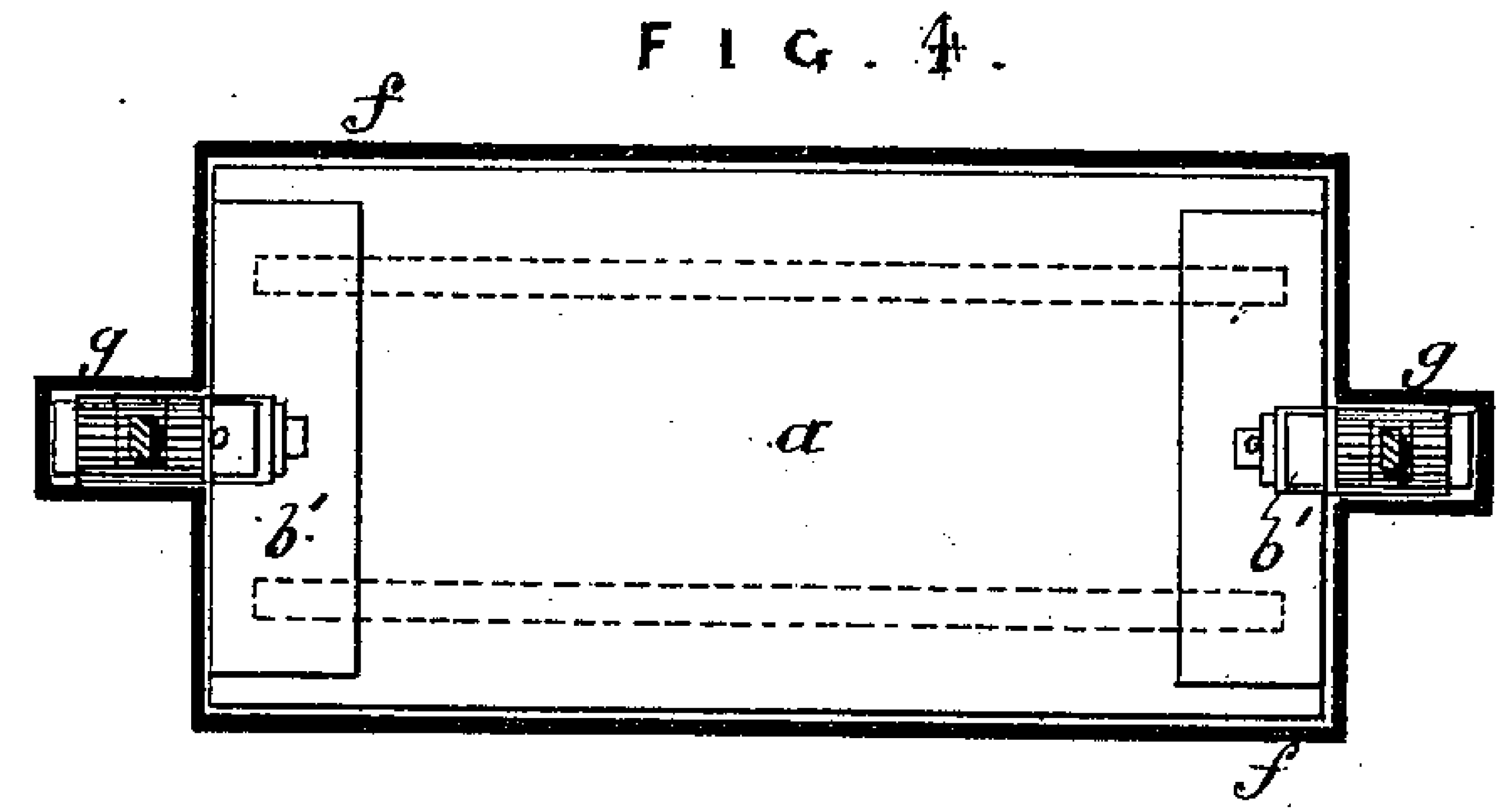


FIG. 3.

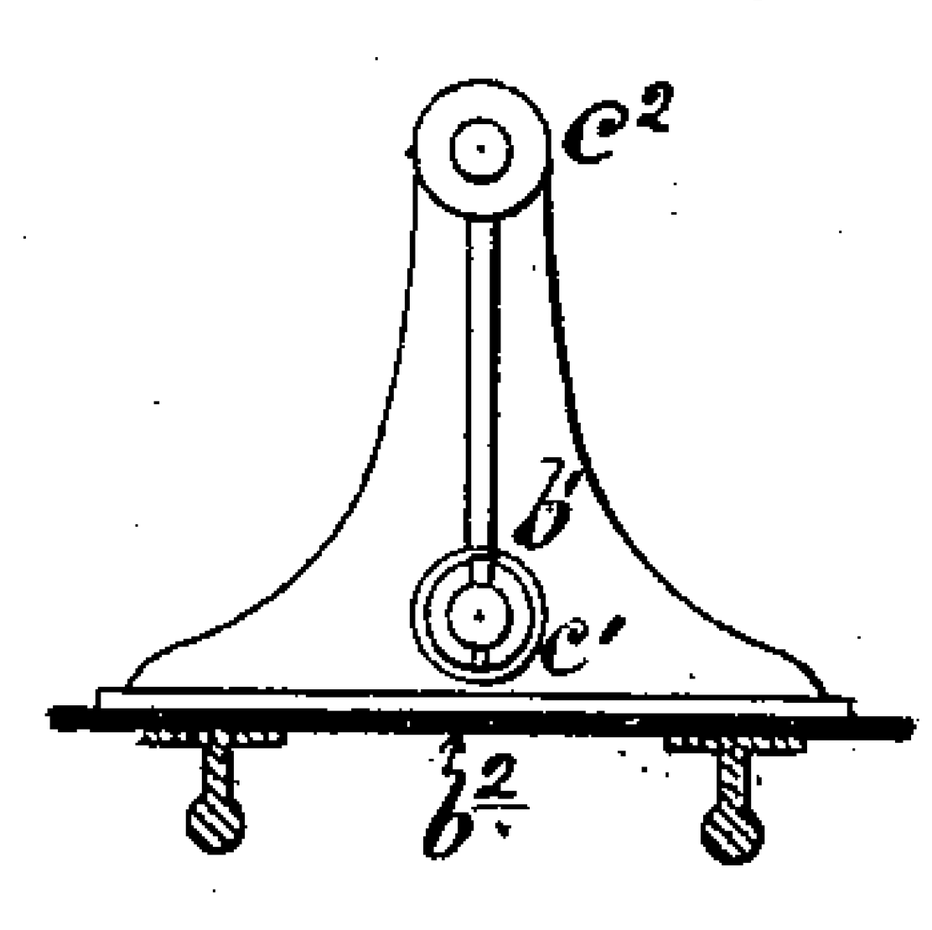


FIG. 5.

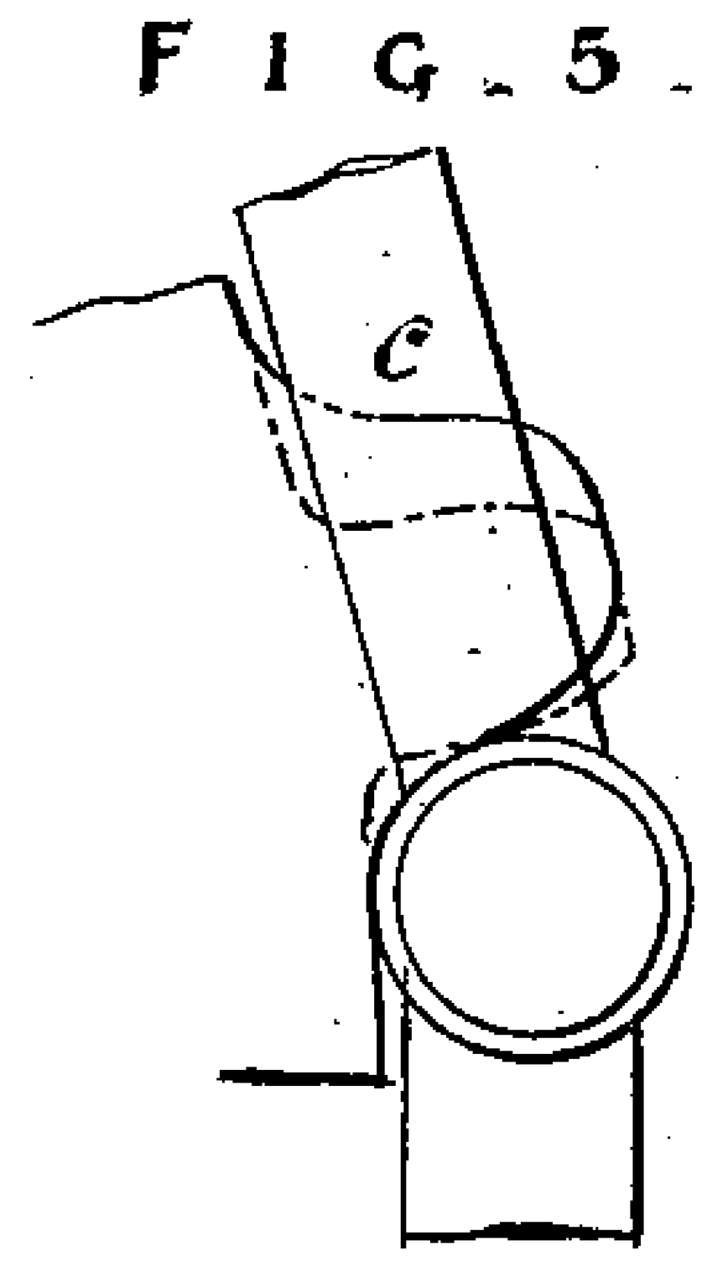
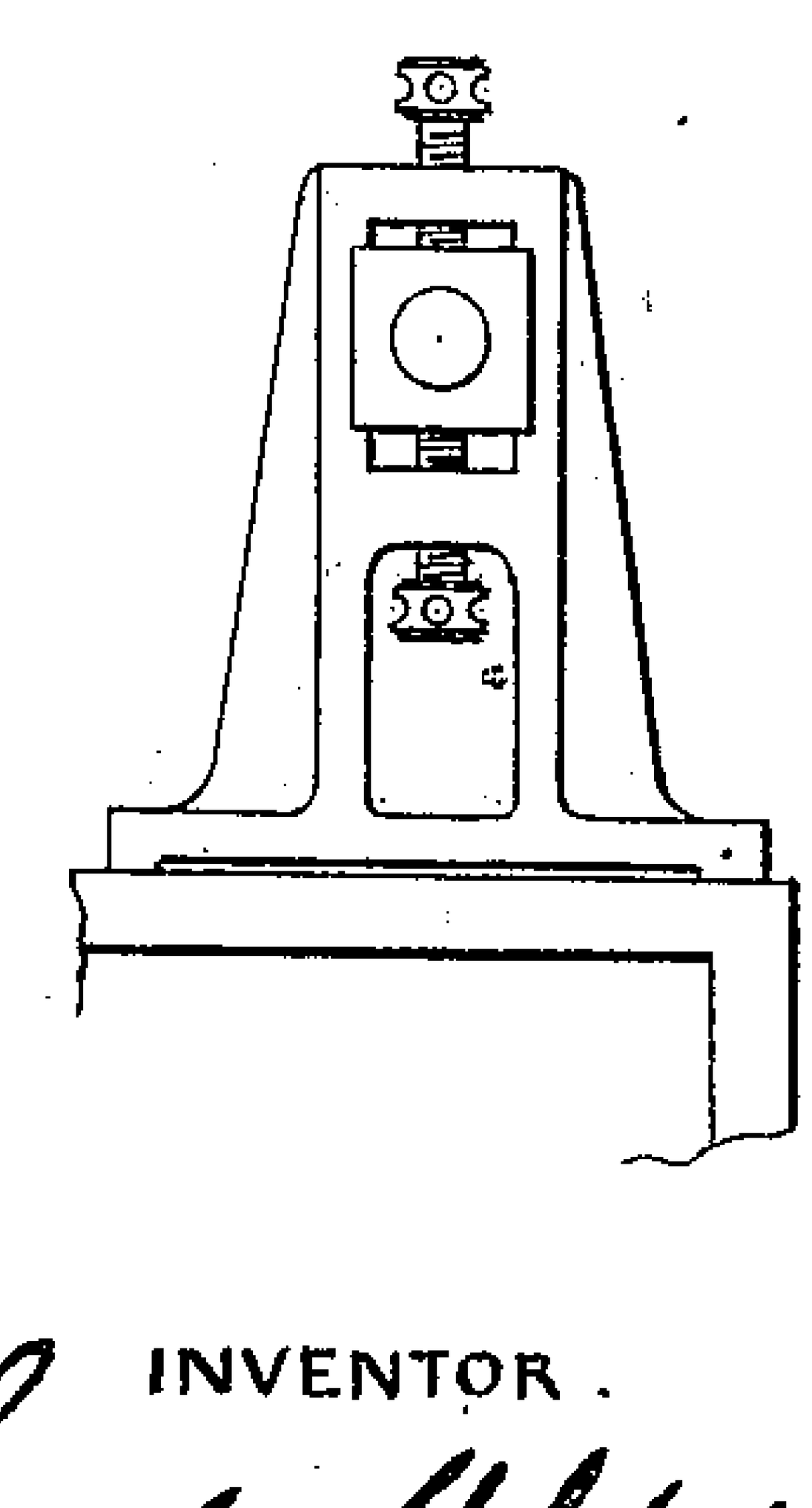


FIG. 6.



WITNESSES,

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UNITED STATES PATENT OFFICE.

SAMUEL SEALY ALLIN, OF BEDFORD PARK, COUNTY OF MIDDLESEX, ENGLAND.

WATER-MOTOR.

SPECIFICATION forming part of Letters Patent No. 379,753, dated March 20, 1888.

Application filed March 9, 1887. Serial No. 230,206. (No model.) Patented in France February 20, 1885, No. 167,171, and in England October 9, 1885, No. 11,994.

To all whom it may concern:

Be it known that I, SAMUEL SEALY ALLIN, a subject of the Queen of Great Britain, residing at 52 Woodstock Road, Bedford Park, in the county of Middlesex, England, have invented new and useful Improvements in the Construction of Water-Motors, of which the following is a specification.

The object of this invention is to obtain from water-power a larger percentage of force than has hitherto been obtained.

In order that the invention may be well understood and explained in detail, I have hereunto annexed a sheet of drawings, on which letters of reference are marked on corresponding parts on all the figures alike.

In the drawings, Figure 1 represents a side view, partly in section, of a motor having a trunk or casing, a shaft, two chain-wheels, a pair of chains, and horizontal balanced floats carried in cradles between the chains, and a pair of pulleys at bottom, round which the chains pass. Fig. 2 is a front view of some of the links of the chains of the motor, showing the form of the link, the construction of the cradle, and its mode of attachment to the chains. Fig. 3 is an end view of the cradle. Fig. 4 represents a horizontal section through line *x x* of Fig. 1, showing the chains in the guide-grooves and the floats fitting the casing. Fig. 5 shows a portion of periphery of the chain-wheel and chain with the form of cog I employ. Fig. 6 shows an arrangement for taking up the slack of the chains by raising the upper shaft and wheels.

The motor, Fig. 1, consists of a series of horizontal floats, *a*, suspended in cradles *b* between a pair of endless chains, *c*, passing over a pair of wheels, *d*, into which they gear, and which are keyed on a shaft, *d'*, above the upper water-level of a pair of pulleys, *e*, placed vertically under the upper wheels on a shaft near the lower water-level, and of a casing or trunk, *f*, down which the floats travel. The chains *c* constitute an endless carrier for the floats and cradles. The floats *a* are suspended between the chains *c*, and it is highly desirable, to avoid friction and to enable the chains to run steadily, that they shall be suspended centrally in such a way that they are balanced, so that when traveling downward with their load of water the center of gravity of each and of the whole series may be vertically under a line connecting their points of suspension on the peripheries of the wheels. The floats *a* are not attached to the links of the chain *c*, but are carried in cradles *b*, suspended from the pin *c'*.

The cradles consist of a pair of brackets, *b' b'*, one at each end, (see Figs. 3 and 4,) connected by braces b^2, preferably of bulb-iron, (shown in section at Fig. 4,) riveted to each and to the float, so that the whole may be sufficiently rigid to bear the load of water without flexure or torsion, which I have found of the first importance in working. These cradles *b* are carried by one pair of pins, *c'*, (see Fig. 3,) and steadied by the pair c^2 above, and serve the secondary purpose of keeping the chains *c* exactly the right distance apart. By means of these pins *c' c²* the cradle is attached at each end to the chain at two points corresponding to the joints of the links, as shown.

It will be seen by Fig. 2 that the floats, not being attached to the links, but carried in cradles, as described, are placed in advance of the pair of links to which they belong, as would not be the case if they were directly attached to them, and thus I attain the important advantage of feathering the floats when passing through the lower water, as is seen at Fig. 1, and I get this feathering without any swiveling of the floats or relative motion, and so avoid complication and wear. Furthermore, each cradle, being attached to the chain at two points corresponding to the joints thereof, is carried and braced by three links on each side, and the strain comes chiefly in the line passing through the two points of attachment on each side, where the resisting-power is greatest. Each float moves with perfect regularity and without any swiveling or rocking; but its cradle and chain attachments present it in the best possible position for the work it has to do and reduce the resistance of the water as the float leaves it to the least possible amount.

The floats may be of any suitable material—metal or wood—and plain or corrugated; but I prefer light steel plates supported by the bulb-irons of the cradles longitudinally and strengthened at the edges by iron straps, and, if wide, stiffened by transverse T or angle iron.

The horizontal flat float has important advantages over either an inclined or a curved one. Being horizontal, the moment it enters the surface of the upper water the water flows in, and, being flat, the weight begins to act at once, while, if it were curved and hollow, the water would have to pursue it some distance before reaching its bottom, and so much of the fall would be wasted. It would also be almost impracticable to balance a series of floats when loaded if they were not horizontal.

The chains may be of any suitable material or pattern; but I prefer annealed steel castings of the spur shape shown at Fig. 2, and I limit the movement on the pin to the pair of eyes, keeping it fixed in the single eye by a cross-pin passed through it where it passes through the brackets *b'*. (See Fig. 3.)

The wheels *d* are slightly longer in pitch than the chains *c*, and the cogs are of a peculiar shape, receding in a quickening curve from a point just outside the pitch-line outward and advancing from the same point inward, as shown in Fig. 5, where the cog is seen superimposed on a cog of the usual shape.

The casing down which the floats descend may be of iron or wood, or even of brick or stone faced with cement; but the guides should be of iron. I prefer a casing of which the ends are cast-iron, with the guide-channels *g* (see Fig. 4) planed out to fit the heads of the chain-links, and the back and front either of cast or plate iron.

It is essential to good working that the chains shall fit the guides more closely than the floats do the trunk, so that the latter shall nowhere touch the trunk, a space of one-sixteenth of an inch all round the floats and of one thirty-second of an inch round the chains would be as close a fit as could be attained in practice, and would allow no leakage.

The action of the motor when working is as follows: Each float, as it descends to where the water is entering, begins to fill from the surface nearly on the level, and continues filling till the succeeding float cuts off the water from it. The space between the two is never quite filled with water, as a body of air is always imprisoned, and this prevents the formation of a continuous column of water in the machine. The water is in a series of isolated troughs formed by the floats and the trunk, and though it acts with its full weight on the chains, and through them on the wheels, it nowhere exercises on the trunk a pressure greater than that due to the depth of water on the individual float passing down at any moment. The water on each float carries it down with the full force due to its weight through the whole fall till it reaches the tail-water, from which, in consequence of the angle at which it (the float) is placed by the feathering arrangement, it emerges almost without resistance.

The only necessary losses of power in this machine are the force required to overcome *vis inertiæ* of the machine itself, a loss of two or three inches in taking the water in, skin-friction in the casing, and the trivial resistance of tail-water. All these on a fall of, say, twenty feet need not exceed five per cent., leaving a possible efficiency of ninety-five per cent., and in practice I have got ninety-three per cent.

I am aware that the construction of the machine might be varied in more than one respect—as, for instance, floats with a back and ends might be made to work in a partial casing. Feathering involving swiveling of the floats might be employed, or the floats might be placed out of balance, or in small motors the floats might be balanced on a single chain; but all these are very inferior to the arrangement I have described.

Having fully described my invention, what I desire to claim and secure by Letters Patent is—

1. In combination with a pair of endless chains and a set of floats, a set of rigid cradles to which said floats are attached, each cradle consisting of brackets *b' b'* and a connecting-brace, b^2, extending across the space between the chains, said cradle being attached to each of said chains at two points corresponding to the joints of the links, for the purpose set forth.

2. In combination with a pair of endless chains and a set of floats, a set of cradles, each having one of said floats attached thereto and connected at each of its ends to two proximate links of said chains at two points corresponding to the joints of the links, for the purposes set forth.

3. A pair of endless chains and a set of cradles attached thereto by pins *c'*, in combination with the steadying-pins c^2 and the flat floats attached to said cradles, substantially as described.

4. The combination of the chains, cradles, and floats, each float being arranged in advance of a link, and each cradle being suspended from pins on the chains, substantially as described.

5. In combination with a pair of endless chains and a hollow trunk through which they pass, a set of floats carried by said chains, each of said floats being attached at each end to each of said chains at two points corresponding to the joints of the links, and arranged in advance of the links to which it belongs, for convenience in feathering, as set forth.

6. An endless carrier and a hollow trunk through which it passes, in combination with a series of floats, each float being attached to said carrier at two points corresponding to the joints of the links thereof and in advance of a link of said carrier, to which it is attached, for convenience in feathering, as set forth.

In witness whereof I have hereunto set my hand this 18th day of February, 1887.

S. SEALY ALLIN.

Witnesses:
THOS. WRIGLEY,
WM. THOS. MARSHALL.